Safety Specification for the Pulsed Fast Neutron Analysis (PFNA) Inspection System at Ysleta Port of Entry Commercial Cargo Facility

October 15, 2002

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1. RADIATION SAFETY REQUIREMENTS

The accelerator **shall** be operated in accordance with standards specified in Chapter 10, Part 20 of the Code of Federal Regulations (10 CFR 20).

The maximum permissible whole body dose for a radiation worker **shall** be no more than 5 rem/year. Technicians who perform maintenance on the PFNA will be "Radiation Workers" to whom this higher occupational level applies.

The PFNA shall be capable of being operated under normal circumstances without a radiation worker present. The PFNA Operator **shall** work in a location where the exposure is less than 50 microrem/hour.

2. SHIELDING AND SAFETY DESIGN REQUIREMENTS:

The accelerator installation shall be provided with such primary and secondary barriers as are necessary to assure radiation exposure shall not exceed 50 microrem/hour at any point Five (5.0) centimeters or greater outside the vertical surfaces of the facility above natural background radiation.

The accelerator installation shall be provided with such primary and secondary barriers as are necessary to assure the affect of skyshine or other reflected radiation maintains the less than 50 microrem as measured Five (5.0) centimeters or greater outside the vertical surfaces of the facility above natural background radiation.

The maximum exposure to a person inadvertently exposed to radiation inside the tunnel **shall** be less than 100-millirem/single-side vehicle scan. The speed of the vehicle through the PFNA, the speed of the scan arm of the PFNA and the beam intensity **shall** be monitored and the generation of the PFNA external neutron beam stopped automatically should the system be operating at levels that exceed normal parameters or that approach the levels of this requirement. Images and controls **shall** be in place to ensure that the PFNA Operator declares the vehicle clear of personnel before the vehicle is released or sent for additional scans of the PFNA.

A tow vehicle that encounters an out of specification operating condition **shall** result in the tow vehicle stopping.

3. PARTICLE ACCELERATOR CONTROLS AND INTERLOCK SYSTEMS

Instrumentation, readouts, and controls on the particle accelerator control console **shall** be identified and discernible.

Doors to the areas of the facility where an individual could receive a radiation dose in excess of 50 microrem/hour **shall** be provided with safety interlocks that shut down generation of the PFNA external neutron beam under conditions of barrier penetration or opening(s). Safety interlocks **shall** accommodate PFNA Cargo Inspection Equipment

maintenance modes that differ from the PFNA Cargo Inspection Equipment operating mode. Maintenance workers could receive a radiation dose that is consistent with performing their duties under the "Federal Radiation Standards".

Each safety interlock **shall** be on a circuit that **shall** allow it to operate independently of all other safety interlocks, meet building code requirements and be installed per manufactures recommended procedures.

All safety interlocks **shall** operate within specifications. Any out of specification condition **shall** stop the generation of the PFNA external neutron beam.

When a safety interlock system has been tripped, it **shall** only be possible to resume operation of the accelerator by manually resetting controls at the position where the safety interlock has been tripped and, lastly, at the main control console.

An E-STOP button or other emergency cutoff device **shall** be located and easily identifiable in all high radiation areas and at each entrance into the inspection tunnel. Such a cutoff switch **shall** include a manual reset so that the generation of the PFNA external neutron beam cannot be restarted from the operator's console without resetting the cutoff device.

An E-STOP button or other emergency cutoff device **shall** be located and easily identifiable on the control panel of the PFNA system. This **shall** be used if (1) an individual is in an area of high radiation, (2) if the speed of the tow mechanism is too slow, (3) if the beam strength is too high, (4) if the scan arm rate is too low or (5) any combination of these events would expose a person inadvertently to radiation in excess of 100 millirem/hour. Such a cutoff device **shall** include a manual reset.

4. WARNING DEVICES

Each location where an individual could receive a radiation dose in excess of 50 microrem/hour and entrances to these locations shall be equipped with easily observable warning lights that operate when, and only when, radiation is being produced.

All areas shall have observable indicators that the PFNA system is on but not generating an external neutron beam.

Except in facilities designed for human exposure, each area where an individual could receive a radiation dose in excess of 50 microrem/hour shall have both visible and audible warning devices which shall be activated for 15 seconds prior to the generating of the PFNA external neutron beam. Such warning device shall be clearly discernible in and near all effected areas.

Prior to generation of the PFNA external neutron beam, the tunnel area shall be visually verified empty of personnel, by the PFNA Operator, and the access doors closed and interlock switches set. There shall be a physical input by the PFNA Operator to verify that this inspection has been done before the scan can proceed.

Barriers, temporary or otherwise, and pathways leading to areas where an individual could receive a radiation dose in excess of 50 microrem/hour shall be posted in accordance with current radiation safety standards and regulations.

5. OPERATING REQUIREMENTS

To prevent unauthorized use, a control panel key and password **shall** be required to operate the PFNA system.

A copy of the current operating and the emergency procedures **shall** be supplied with the PFNA Inspection System and **shall** be considered part of the control panel.

The safety camera system **shall** have a port that allows an operator to attach video equipment to record camera output.

6. RADIATION MONITORING REQUIREMENTS

Radiation levels inside the (1) inspection tunnel and (2) accelerator room shall be monitored and monitors shall provide readouts at the control panel.

All monitoring devices shall be electrically independent of the accelerator control and safety interlock systems and shall meet code requirements.

7. VENTILATION SYSTEMS

Ventilation systems shall be provided to ensure that personnel entering any area where airborne tritium may be produced shall not be exposed to airborne tritium in excess of an effective dose equivalent limit of 10 millirem/year.

The PFNA facility, shall not vent, release, or otherwise discharge airborne tritium to the surrounding environs such that any individual could receive a resulting dose in excess of 10 millirem/year.

The design of the venting system shall assure that all vented tritium is in compliance with the US Environmental Protection Agency “exempt” air concentration limit. Compliance shall be determined using the release and design parameters (stack height, activity, air volume, etc.) in running the EPA “Comply” computer code.

8. NOISE LEVEL REQUIREMENTS

All noise levels as measured outside the facility, during operation of the PFNA facility **shall** be below 85 decibels and in total compliance with Federal standards and regulations, specifically the occupational Health and Safety Administration (OSHA).

9. STORAGE OF HAZARDOUS MATERIALS REQUIREMENTS

All non-radiological hazardous material stored in or on the PFNA facility **shall** be in a properly labeled fire-retardant locked cabinet or other approved container in compliance with Federal regulations and standards, specifically the Environmental Protection Agency (EPA) and the Occupational Safety and Health Administration (OSHA).

All radiological material stored in the PFNA facility **shall** be stored in a lead lined storage container to maintain radiation exposure levels in compliance with Federal Radiation Standards, prior to disposal as Low Level Radioactive Waste (LLRW).

10. INDUSTRIAL SAFETY REQUIREMENTS

Safety standards for most industrial environments are well established (OSHA 29 CFR 1910), and this section merely points out certain specific industrial hazards that are often found in accelerator facilities.

Electric circuits and interconnections **shall** be wired and installed in accordance with accepted electrical building codes.

Fire extinguishers of the appropriate type to combat electrical or solvent fires **shall** be conspicuously installed around the PFNA facility.